

What I claim is:

1 A reinforced polyvinyl alcohol structure, said structure having  
(A) a physically cross linked polyvinyl alcohol based matrix derived  
5 from a bulk physically crosslinkable polyvinyl alcohol hydrogel and  
(B) a reinforcing material capable of reinforcing said matrix.

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2. A laminated polyvinyl alcohol structure, said structure having:

(A) a physically cross linked polyvinyl alcohol based matrix derived from a bulk physically crosslinkable polyvinyl alcohol hydrogel laminated with

(B) a solid material.

5 3. A polyvinyl alcohol impregnated structure comprising:

(A) a solid structure, said structure being impregnated with

(B) a physically crosslinkable polyvinyl alcohol based matrix derived from a bulk physically crosslinkable polyvinyl alcohol hydrogel.

4. A reinforced polyvinyl alcohol structure, said structure having

10 (A) a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically crosslinkable polyvinyl alcohol hydrogel and

(B) a reinforcing material capable of reinforcing said matrix.

5. A laminated polyvinyl alcohol structure, said structure having:

(A) a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically crosslinkable polyvinyl alcohol hydrogel laminated with

(B) a solid material.

6. A polyvinyl alcohol impregnated structure comprising:

(A) a solid structure, said structure being impregnated with

(B) a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically crosslinkable polyvinyl alcohol hydrogel.

7. A polyvinyl alcohol impregnated structure comprising:

(A) a solid structure, said structure being impregnated with

(B) a covalently cross linked polyvinyl alcohol based matrix derived from a cellular covalently crosslinkable polyvinyl alcohol hydrogel.

25 8. A composite structure comprising two or more physically cross linked polyvinyl alcohol based matrices each derived from a bulk physically crosslinkable polyvinyl alcohol hydrogel.

9. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 8 and a

30 reinforcing material capable of reinforcing said matrix.

10. A laminated polyvinyl alcohol structure, said structure having:  
a polyvinyl alcohol based material with composite properties as a matrix as  
claimed in claim 8 laminated with a solid material.

11. A polyvinyl alcohol impregnated structure comprising:  
5 a solid structure, said structure being impregnated with a polyvinyl alcohol based  
material with composite properties as a matrix as claimed in claim 8:

12. A composite structure comprising two or more physically cross linked polyvinyl  
alcohol based matrices each derived from a cellular physically cross linkable polyvinyl  
alcohol hydrogel.

10 13. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol  
based material with composite properties as a matrix as claimed in claim 12 and a  
reinforcing material capable of reinforcing said matrix.

14. A laminated polyvinyl alcohol structure, said structure having a polyvinyl alcohol  
based material with composite properties as a matrix as claimed in claim 12 laminated  
15 with a solid material.

15. A polyvinyl alcohol impregnated structure comprising: a solid structure, said  
structure being impregnated with a polyvinyl alcohol based material with composite  
properties as a matrix as claimed in claim 12.

16. A composite structure comprising two or more covalently cross linked polyvinyl  
alcohol based matrices each derived from a cellular covalently cross linkable polyvinyl  
alcohol hydrogel.

20 17. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol  
based material with composite properties as a matrix as claimed in claim 16 and a  
reinforcing material capable of reinforcing said matrix.

25 18. A laminated polyvinyl alcohol structure, said structure having a polyvinyl alcohol  
based material with composite properties as a matrix as claimed in claim 16 laminated  
with a solid material.

19. A polyvinyl alcohol impregnated structure comprising a solid structure, said  
structure being impregnated with a polyvinyl alcohol based material with composite  
30 properties as a matrix as claimed in claim 16.

20. A composite structure comprising at least one physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel and at least one covalently cross linked polyvinyl alcohol based matrix derived from a cellular covalently cross linkable polyvinyl alcohol hydrogel.

5 21. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 20 and a reinforcing material capable of reinforcing said matrix.

22. A laminated polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 20 laminated with a solid material.

10 23. A polyvinyl alcohol impregnated structure comprising a solid structure, said structure being impregnated with a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 20.

15 24. A composite structure comprising at least one physically cross linked polyvinyl alcohol based matrix derived from a bulk physically cross linkable polyvinyl alcohol hydrogel and at least one physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel.

20 25. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 24 and a reinforcing material capable of reinforcing said matrix.

26. A laminated polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 24 laminated with a solid material.

25 27. A polyvinyl alcohol impregnated structure comprising a solid structure, said structure being impregnated with a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 24.

28. A composite structure comprising at least one physically cross linked polyvinyl alcohol based matrix derived from a bulk physically cross linkable polyvinyl alcohol hydrogel and at least one covalently cross linked polyvinyl alcohol based matrix derived from a cellular covalently cross linkable polyvinyl alcohol hydrogel.

29. A reinforced polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 28 and a reinforcing material capable of reinforcing said matrix.

30. A laminated polyvinyl alcohol structure, said structure having a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 28 laminated with a solid material.

31. A polyvinyl alcohol impregnated structure comprising a solid structure, said structure being impregnated with a polyvinyl alcohol based material with composite properties as a matrix as claimed in claim 28.

32. A polyvinyl alcohol structure, said structure having:  
a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix is a hydrogel sponge having collapsed walls which has been prepared by the method comprising the steps of:

(I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution formed in (II) with a pore-forming material;

(IV) providing conditions for the mixture of (III) in which the polyvinyl alcohol polymer will undergo physical cross linking;

(V) bringing the mixture from (IV) to about room temperature;

(VI) removing all of the solvents by a means which does not significantly affect the cross linking or pore forming material;

(VII) heating the material at an elevated temperature for a period of time of ten seconds to eight hours, and

(VIII) cooling the mixture from (VII) to about room temperature and removing the pore forming material by a means which does not significantly affect the cross linking.

33. A polyvinyl alcohol structure as claimed in claim 32 that is reinforced.
- 5 34. A polyvinyl alcohol structure as claimed in claim 32 that is a laminate.
35. A polyvinyl alcohol structure as claimed in claim 32 that is a material with composite properties.
36. A polyvinyl alcohol structure as claimed in claim 32 that is an impregnated solid structure.

10 37. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix is a hydrogel sponge having expanded walls which has been prepared by the method comprising the steps of:

15 (I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

20 (ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution formed in (II) with a pore forming material;

(IV) providing conditions for the mixture of (III) in which the polyvinyl alcohol polymer will undergo physical cross linking;

25 (V) bringing the mixture from (IV) to about room temperature;

(VI) removing the pore forming material by a means which does not significantly affect the cross linking or pore forming material.

38. A polyvinyl alcohol structure as claimed in claim 37 that is reinforced.

39. A polyvinyl alcohol structure as claimed in claim 37 that is a laminate.

30 40. A polyvinyl alcohol structure as claimed in claim 37 that is a material with composite properties.

41. A polyvinyl alcohol structure as claimed in claim 37 that is an impregnated solid structure.

~~42.~~ A polyvinyl alcohol structure, said structure having a physically cross linked polyvinyl alcohol based matrix derived from a 5 cellular physically crosslinkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

(I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

10 (II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to

form a solution;

15 (III) mixing the solution formed in (II) with a pore-forming material capable of partially dissolving in solution (II) and its solution capable of causing formation of physical cross linking in the polyvinyl alcohol polymer;

(IV) providing conditions at which the polyvinyl alcohol polymer of (III) will undergo physical cross linking caused by the presence of the partially dissolved pore forming material;

(V) bringing the mixture from (IV) to about room temperature;

(VI) removing the pore forming material by a means which does not significantly affect the cross linking or pore forming material.

43. A polyvinyl alcohol structure as claimed in claim 42 that is reinforced.

25 44. A polyvinyl alcohol structure as claimed in claim 42 that is a laminate.

45. A polyvinyl alcohol structure as claimed in claim 42 that is a material with composite properties.

46. A polyvinyl alcohol structure as claimed in claim 42 that is an impregnated solid structure.

47. A polyvinyl alcohol structure, said structure having a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

5 (I) providing a polyvinyl alcohol polymer capable of being physically

cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and ,

10 (ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution formed in (II) with a pore forming material;

(IV) submersing the mixture from (III) in a bath consisting of a material selected from the group consisting essentially of:

15 (a) a solvent for the polyvinyl alcohol polymer wherein the solvent is a non-solvent at low temperature for the polyvinyl alcohol polymer;

(b) a non-solvent for the polyvinyl alcohol polymer,

(c) a poor solvent for the polyvinyl alcohol polymer, and

(d) an aqueous solution of a material selected from the group

20 consisting essentially of:

(i) a salt;

(ii) an acid at a low temperature, and

(iii) a base,

to induce crystallization, gellation, coagulation, or a mixture of crystallization, gellation,

25 or coagulation, of the polyvinyl alcohol polymer;

(V) providing conditions at which the polyvinyl alcohol polymer of submersed mixture of (III) will undergo further physical crosslinking in a bath of (IV);

(VI) bringing the mixture from (V) to about room temperature and removing essentially all of the pore forming materials by means which do not significantly affect the cross linking.

30 48. A polyvinyl alcohol structure as claimed in claim 47 that is reinforced.

49. A polyvinyl alcohol structure as claimed in claim 47 that is a laminate.

50. A polyvinyl alcohol structure as claimed in claim 47 that is a material with composite properties.

51. A polyvinyl alcohol structure as claimed in claim 47 that is an impregnated solid structure.

52. A polyvinyl alcohol structure, said structure having a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

10 (I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

15 (II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

15 (i) a single solvent for the polyvinyl alcohol polymer and,

15 (ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

20 (III) mixing the solution from (II) with a material selected from the group consisting essentially of:

20 (a) a surface active agent and,

20 (b) a mixture of surface active agents and frothing said mixture;

20 (IV) cooling the frothed mixture from (III) to a temperature at which the polyvinyl alcohol polymer will undergo physical cross linking;

20 (V) essentially removing any solvent present in the frothed mixture by a means which does not significantly affect the cross linking;

25 (VI) bringing the mixture to an elevated temperature for a period of 10 seconds to 8 hours and cooling the mixture to about room temperature.

53. A polyvinyl alcohol structure as claimed in claim 52 that is reinforced.

54. A polyvinyl alcohol structure as claimed in claim 52 that is a laminate.

55. A polyvinyl alcohol structure as claimed in claim 52 that is a composite.

30 56. A polyvinyl alcohol structure as claimed in claim 52 that is an impregnated solid structure.

57. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

(I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to

form a solution;

(III) mixing the solution from (II) with a material selected from the groups consisting essentially of:

(a) a surface active agent and,

(b) a mixture of surface active agents and frothing said mixture;

(IV) cooling the frothed mixture from (III) to a temperature at which the polymer will undergo physical cross linking;

(V) bringing the mixture to about room temperature.

58. A polyvinyl alcohol structure as claimed in claim 57 that is reinforced.

59. A polyvinyl alcohol structure as claimed in claim 57 that is a laminate.

60. A polyvinyl alcohol structure as claimed in claim 57 that is a material with composite properties.

61. A polyvinyl alcohol structure as claimed in claim 57 that is an impregnated solid structure.

62. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel and wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

(I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

5 (i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution from (II) with a material selected from the group consisting essentially of:

10 (a) a surface active agent, and

(b) a mixture of surface active agents and frothing said mixture;

(IV) cooling the frothed mixture from (III) to a temperature at which the polyvinyl alcohol polymer will undergo physical cross linking;

(V) submersing the mixture from (IV) into a bath consisting essentially of a material selected from the group consisting of:

15 (i) a solvent that is a non-solvent at low temperature for the polyvinyl alcohol polymer,

(ii) a non-solvent for the polyvinyl alcohol polymer,

(iii) a poor solvent for the polyvinyl alcohol polymer,

20 (iv) an aqueous solution of a salt,

(v) an aqueous solution of an acid at low temperature, and,

(vi) an aqueous solution of a base,

to induce crystallization, gellation, coagulation, or a mixture of crystallization, gellation, or coagulation of said polyvinyl alcohol polymer:

25 (VI) providing conditions at which the polyvinyl alcohol polymer of frothed mixture of (III) will undergo further physical crosslinking in a bath of (V);

(VII) bringing the mixture to about room temperature.

63. A polyvinyl alcohol structure as claimed in claim 62 that is reinforced.

64. A polyvinyl alcohol structure as claimed in claim 62 that is a laminate.

30 65. A polyvinyl alcohol structure as claimed in claim 62 that is a material with composite properties.

66. A polyvinyl alcohol structure as claimed in claim 62 that is an impregnated solid structure.

67. A polyvinyl alcohol structure, said structure having:

5 a physically cross linked polyvinyl alcohol based matrix derived from a combined cellular and bulk physically cross linkable polyvinyl alcohol hydrogel and wherein the combined cellular and bulk physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

10 (I) providing a polyvinyl alcohol polymer capable of being physically crosslinked;

15 (II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to

20 form a solution,

15 (III) mixing the solution from (II) with a material selected from the group consisting of:

(a) a surface active agent and,

(b) a mixture of surface active agents and frothing said mixture;

(IV) combining the froth formed in (III) with polyvinyl alcohol polymer

25 solution:

(V) providing conditions for a material with composite properties for the mixture from (IV) at which the polymer will undergo physical cross linking;

(VI) bringing the mixture to about room temperature.

68. A polyvinyl alcohol structure as claimed in claim 67 that is reinforced.

25 69. A polyvinyl alcohol structure as claimed in claim 67 that is a laminate.

70. A polyvinyl alcohol structure as claimed in claim 67 that is a material with composite properties.

71. A polyvinyl alcohol structure as claimed in claim 67 that is an impregnated solid structure

72. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a combined cellular and a bulk physically cross linkable polyvinyl alcohol hydrogel and wherein the combined cellular and a bulk physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

5 (I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

10 (i) a single solvent for the polyvinyl alcohol polymer and,

(ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution formed in (II) with a pore forming material;

(IV) combining the mixture of (III) with polyvinyl alcohol polymer

15 solution;

(V) providing conditions for a material with composite properties for the mixture from (IV) at which the polymer will undergo physical cross linking;

(VI) bringing the mixture to about room temperature;

20 (VII) removing the pore forming material by a means which does not significantly affect the cross linking.

73. A polyvinyl alcohol structure as claimed in claim 72 that is reinforced.

74. A polyvinyl alcohol structure as claimed in claim 72 that is laminated.

75. A polyvinyl alcohol structure as claimed in claim 72 that is a material with composite properties.

25 76. A polyvinyl alcohol structure as claimed in claim 72 that is an impregnated solid structure.

77. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel and wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

(I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

5 (i) a single solvent for the polyvinyl alcohol polymer and,  
(ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution from (II) with a material selected from the group consisting of:

10 (a) a surface active agent and,  
(b) a mixture of surface active agents and frothing said mixture;

(IV) combining the froth formed in (III) with polyvinyl alcohol polymer solution containing a pore forming material;

(V) cooling the a material with composite properties mixture from (IV)

15 to a temperature at which the polymer will undergo physical cross linking;

(VI) bringing the mixture to about room temperature;

(VII) removing the pore forming material by a means which does not significantly affect the cross linking.

78. A polyvinyl alcohol structure as claimed in claim 77 that is reinforced.

16 79. A polyvinyl alcohol structure as claimed in claim 77 that is a laminate.

80. A polyvinyl alcohol structure as claimed in claim 77 that is a material with composite properties.

81. A polyvinyl alcohol structure as claimed in claim 77 that is an impregnated solid structure.

25 82. A polyvinyl alcohol structure, said structure having:  
a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically crosslinkable polyvinyl alcohol hydrogel and wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

30 (I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

- (i) a single solvent for the polyvinyl alcohol polymer and,
- (ii) a mixture of solvents for the polyvinyl alcohol polymer, to

5 form a solution;

(III) mixing the solution from (II) with material selected from the group consisting of:

- (a) a surface active agent and,
- (b) a mixture of surface active agents and frothing said mixture;

10 (IV) combining the froth formed in (III) with a polyvinyl alcohol polymer solution containing a pore forming material;

(V) cooling the a material with composite properties mixture from (IV) to a temperature at which the polyvinyl alcohol polymer will undergo physical cross linking;

15 (VI) submersing the resulting a material with composite properties material from (V) in a bath consisting of a material selected from the group consisting essentially of:

- (a) a solvent that is a non-solvent at low temperature for the polyvinyl alcohol polymer,
- (b) a non-solvent for the polyvinyl alcohol polymer,
- (c) a poor solvent for the polyvinyl alcohol polymer,
- (d) an aqueous solution of a salt,
- (e) an aqueous solution of an acid at low temperature, and,
- (f) an aqueous solution of a base,

20 (VII) providing conditions at which the polyvinyl alcohol polymer from (IV) will undergo physical cross linking;

(VIII) bringing the mixture from (VII) to about room temperature;

(IX) removing the pore forming material by a means which does not significantly affect the cross linking.

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30 83. A polyvinyl alcohol structure as claimed in claim 82 that is reinforced.

84. A polyvinyl alcohol structure as claimed in claim 82 that is a laminate.

85. A polyvinyl alcohol structure as claimed in claim 82 that is a material with composite properties.

86. A polyvinyl alcohol structure as claimed in claim 82 that is an impregnated solid structure.

5 87. A polyvinyl alcohol structure, said structure having:

a physically cross linked polyvinyl alcohol based matrix derived from a cellular physically cross linkable polyvinyl alcohol hydrogel and wherein the cellular physically cross linkable polyvinyl alcohol based matrix has been prepared by the method comprising the steps of:

10 (I) providing a polyvinyl alcohol polymer capable of being physically cross linked;

(II) dissolving said polyvinyl alcohol polymer in a material selected from the group consisting essentially of:

(i) a single solvent for the polyvinyl alcohol polymer and,

15 (ii) a mixture of solvents for the polyvinyl alcohol polymer, to form a solution;

(III) mixing the solution from (II) with a material selected from the group consisting of:

(a) a surface active agent and,

(b) a mixture of surface active agents and frothing said mixture;

20 (IV) combining the froth formed in (III) with a solution of polyvinyl alcohol polymer with a pore forming material into a material with composite properties material;

(V) cooling the material with composite properties mixture from (IV) to a temperature at which the polyvinyl alcohol polymer will undergo physical cross linking;

(VI) submersing the resulting a material with composite properties material from (V) in a bath consisting essentially of:

(a) a solvent that is a non-solvent at low temperature for the

30 polyvinyl alcohol polymers,

(b) a non-solvent for the polyvinyl alcohol polymer,

- (c) a poor solvent for the polyvinyl alcohol polymer,
- (d) an aqueous solution of a salt,
- (e) an aqueous solution of an acid at low temperature, and,
- (f) an aqueous solution of a base,

5 (VII) providing conditions at which the polyvinyl alcohol polymer from

(IV) will undergo physical cross linking;

(VIII) bringing the mixture from (VII) to about room temperature;

(IX) removing essentially all of the solvents by a means which does not significantly affect the cross linking or pore forming material,

10 (X) heating the material at an elevated temperature for a period of time from ten seconds to eight hours, and,

(XI) cooling the mixture from (X) to about room temperature and removing the pore forming material by a means which does not significantly affect the cross linking.

15 88. A polyvinyl alcohol structure as claimed in claim 87 that is reinforced.

89. A polyvinyl alcohol structure as claimed in claim 87 that is a laminate.

90. A polyvinyl alcohol structure as claimed in claim 87 that is a material with composite properties.

91. A polyvinyl alcohol structure as claimed in claim 87 that is an impregnated solid structure.

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